

We claim:

1. The use of a polypeptide with the biological activity of an
5 NADH-dependent cytochrome b5 reductase encoded by a nucleic acid sequence consisting of
 - a) a nucleic acid sequence with the nucleic acid sequence shown in SEQ ID NO:1; or
 - 10 b) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence shown in SEQ ID NO:2 by back translation; or
 - 15 c) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence of a functional equivalent of SEQ ID NO:2, which has at least 39% identity with SEQ ID NO:2, by back translation; or
 - 20 d) a functional equivalent of the nucleic acid sequence SEQ ID NO:1 with at least 52% identity with SEQ ID NO:1,
- 25 as target for herbicides.
2. A plant nucleic acid sequence encoding a polypeptide with the biological activity of an NADH-dependent cytochrome b5 reductase comprising a part-region encompassing:
 - 30 a) a nucleic acid sequence with the nucleic acid sequence shown in SEQ ID NO:3; or
 - b) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence shown in SEQ ID NO:4 by back translation; or
 - 35 c) a functional equivalent of the nucleic acid sequence SEQ ID NO:3 with at least 77% identity with SEQ ID NO:3;
 - d) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence of a functional equivalent of SEQ ID NO:4, which has at least 87% identity with SEQ ID NO:4, by back translation.

3. A polypeptide with the biological activity of an NADH-dependent cytochrome b5 reductase as target for herbicides, encoded by a nucleic acid molecule as claimed in claim 2.

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4. A method for detecting functional analogues of SEQ ID NO:1

10 a) by preparing a probe and subsequently screening a genomic library or a cDNA library of the species in question; or

b) by a computer search for analogous sequences in electronic databases.

15 5. An expression cassette comprising

15 a) genetic control sequences in operable linkage with a nucleic acid sequence as claimed in claim 2; or

b) additional functional elements; or

20 c) a combination of a) and b).

25 6. A vector comprising an expression cassette as claimed in claim 5.

25 7. A nonhuman transgenic organism comprising at least one nucleic acid sequence encoding a polypeptide with the biological activity of an NADH-dependent cytochrome b5 reductase as claimed in claim 2, an expression cassette as claimed in claim 5 or a vector as claimed in claim 6 selected from among bacteria, yeasts, fungi, animal cells or plant cells.

35 8. The use of a polypeptide with the biological activity of an NADH-dependent cytochrome b5 reductase encoded by a nucleic acid sequence consisting of

40 a) a nucleic acid sequence with the nucleic acid sequence shown in SEQ ID NO:1; or

b) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence shown in SEQ ID NO:2 by back translation; or

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- c) a functional equivalent of the nucleic acid sequence SEQ ID NO:1 with at least 52% identity with SEQ ID NO:1;
- 5 d) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence of a functional equivalent of SEQ ID NO:2, which has at least 39% identity with SEQ ID NO:2, by back translation,
- 10 in a method for identifying herbicidally active compounds.
- 9. A method for identifying herbicidally active compounds, encompassing the following steps:
- 15 i. bringing a polypeptide with the biological activity of an NADH-dependent cytochrome b5 reductase encoded by a nucleic acid sequence consisting of
 - 20 a) a nucleic acid sequence with the nucleic acid sequence shown in SEQ ID NO:1; or
 - b) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence shown in SEQ ID NO:2 by back 25 translation; or
 - c) a functional equivalent of the nucleic acid sequence SEQ ID NO:1 with at least 52% identity with SEQ ID NO:1; or
 - 30 d) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence of a functional equivalent of SEQ ID NO:2, which has at least 39% identity with SEQ ID NO:2, by back translation
 - 35 into contact with one or more test compounds under conditions which allow the test compound(s) to bind to the NADH-dependent cytochrome b5 reductase; and
 - 40 ii. detecting whether the test compound binds to the NADH-dependent cytochrome b5 reductase of i); or
 - 45 iii. detecting whether the test compound reduces or blocks the activity of the NADH-dependent cytochrome b5 reductase of i); or

iv. detecting whether the test compound reduces or blocks the transcription, translation or expression of the NADH-dependent cytochrome b5 reductase of i).

5 10. A method as claimed in claim 9, which comprises

i. either expressing, in a transgenic organism, NADH-dependent cytochrome b5 reductase which is encoded by a nucleic acid sequence consisting of

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a) a nucleic acid sequence with the nucleic acid sequence shown in SEQ ID NO:1; or

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b) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence shown in SEQ ID NO:2 by back translation; or

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c) a functional equivalent of the nucleic acid sequence SEQ ID NO:1 with at least 52% identity with SEQ ID NO:1; or

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d) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence of a functional equivalent of SEQ ID NO:2, which has at least 39% identity with SEQ ID NO:2, by back translation

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or culturing an organism which naturally contains NADH-dependent cytochrome b5 reductase;

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ii. bringing the NADH-dependent cytochrome b5 reductase of step i) in a cell digest of the transgenic or nontransgenic organism, in partially or homogeneously purified form, into contact with a test compound; and

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iii. selecting a test compound which reduces or blocks the activity of the NADH-dependent cytochrome b5 reductase of step i), where the activity of the NADH-dependent cytochrome b5 reductase incubated with the test compound is compared with the activity of an NADH-dependent cytochrome b5 reductase which is not incubated with a test compound.

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11. A method as claimed in claim 10, wherein, in step iii), the activity of the NADH-dependent cytochrome b5 reductase is determined by using iron(III) cytochrome b5, potassium

iron(III)-cyanide, 2,6-dichlorophenolindophenol, methemerythrin, p-benzoquinone or 5-hydroxy-1,4-naphthoquinone as the substrate.

5 12. A method as claimed in claim 9, which encompasses the following steps:

- 10 i. generating a transgenic organism as claimed in claim 7 or a transgenic organism comprising a nucleic acid sequence encoding a polypeptide with the biological activity of an NADH-dependent cytochrome b5 reductase consisting of
 - 15 a) a nucleic acid sequence with the nucleic acid sequence shown in SEQ ID NO:1; or
 - 15 b) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence shown in SEQ ID NO:2 by back translation; or
 - 20 c) a functional equivalent of the nucleic acid sequence SEQ ID NO:1 with at least 52% identity with SEQ ID NO:1; or
 - 25 d) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence of a functional equivalent of SEQ ID NO:2, which has at least 39% identity with SEQ ID NO:2, by back translation;
- 30 ii. applying a test substance to the transgenic organism of claim i) and to a nontransgenic organism of the same genotype;
- 35 iii. determining the growth or the viability of the transgenic and of the nontransgenic organisms after application of the test substance; and
- 40 iv. selection of test substances which bring about a reduced growth or a reduced viability of the nontransgenic organism in comparison with the growth of the transgenic organism.

45 13. A method as claimed in claim 12, which is carried out in a plant organism or a yeast.

14. A method for identifying growth-regulatory compounds, comprising the following steps:

5 i. generation of a transgenic plant comprising a nucleic acid sequence encoding a polypeptide with the biological activity of an NADH-dependent cytochrome b5 reductase consisting of

10 a) a nucleic acid sequence with the nucleic acid sequence shown in SEQ ID NO:1; or

15 b) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence shown in SEQ ID NO:2 by back translation; or

20 c) a functional equivalent of the nucleic acid sequence SEQ ID NO:1 with at least 52% identity with SEQ ID NO:1; or

25 d) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence of a functional equivalent of SEQ ID NO:2, which has at least 39% identity with SEQ ID NO:2, by back translation; where the polypeptide with the biological activity of an NADH-dependent cytochrome b5 reductase is overexpressed in the transgenic plant;

30 ii. applying a test substance to the transgenic plant of i) and to a nontransgenic plant of the same variety;

35 iii. determining the growth or the viability of the transgenic and of the nontransgenic plants after application of the test substance; and selection of test substances which bring about a modified growth of the nontransgenic plant in comparison with the growth of the transgenic plant.

40 15. A vehicle which has one or more of the nucleic acid molecules as claimed in any of claims 1 to 2, or one or more expression cassettes as claimed in claim 5, or one or more vectors as claimed in claim 6, or one or more organisms as claimed in claim 7 or one or more (poly)peptides as claimed in claim 3.

45 16. A method as claimed in any of claims 9 to 14, wherein the substances are identified in a high-throughput screening.

17. A herbicidally active compound identified by one or the methods as claimed in any of claims 9 to 13 and 16.
18. A growth-regulatory compound identified by the method as claimed in claims 14 and 16.
19. A process for the preparation of an agrochemical composition, which comprises
 - 10 a) identifying a herbicidally active compound by one or the methods as claimed in any of claims 9 to 13 and 16 or a growth-regulatory compound as claimed in claims 14 and 16; and
 - 15 b) formulating this compound together with suitable auxiliaries to give herbicidally or growth-regulatory crop protection products.
20. A method for controlling undesired vegetation and/or for regulating the growth of plants, which comprises allowing at least one compound as claimed in claim 17 or 18 or a compound obtainable by the method stated in claim 19 to act on plants, their environment and/or on seeds.
- 25 21. The use of a compound as claimed in claim 17 or 18 or of an agrochemical formulation obtainable by the method stated in claim 19 in a method as claimed in claim 20 for controlling undesired vegetation and/or for regulating the growth of plants.
- 30 22. A method for generating nucleic acid sequences which
 - i) encode a polypeptide with the biological activity of an NADH-dependent cytochrome b5 reductase which is not inhibited by substances as claimed in claim 17; and which are comprised by a functional equivalent of the nucleic acid sequence of the nucleic acid sequence SEQ ID NO:1 with at least 52% identity with SEQ ID NO:1;
- 35 40 which comprises the following process steps:
 - a) expression, in a heterologous system or in a cell-free system, of the proteins encoded by the nucleic acid according to i);

- b) randomized or site-directed mutagenesis of the protein by modification of the nucleic acid;
- 5 c) measuring the interaction of the modified gene product with the herbicide;
- d) identification of derivatives of the protein which show less interaction;
- 10 e) assaying the biological activity of the protein after application of the herbicide; and
- f) selection of the nucleic acid sequences which show a modified biological activity toward the herbicide.

15 23. A method as claimed in claim 22, wherein the sequences selected in accordance with claim 22 f) are introduced into an organism.

20 24. A method for generating transgenic plants which are resistant to substances as claimed in claim 17, which comprises overexpressing, in these plants, a nucleic acid sequence encoding a polypeptide with the biological activity of an NADH-dependent cytochrome b5 reductase which comprises

25 a) a nucleic acid sequence with the nucleic acid sequence shown in SEQ ID NO:1; or

b) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence shown in SEQ ID NO:2 by backtranslation; or

30 c) a nucleic acid sequence which, on the basis of the degeneracy of the genetic code, can be deduced from the amino acid sequence of a functional equivalent of SEQ ID NO:2 which has at least 39% identity with SEQ ID NO:2; or

35 d) a functional equivalent of the nucleic acid sequence SEQ ID NO:1 with at least 52% identity with SEQ ID NO:1.

40 25. A transgenic plant, generated by a method as claimed in claim 24.